

IE 410 – INTRODUCTION TO ROBOTICS

Lab-1 report

Team M410:

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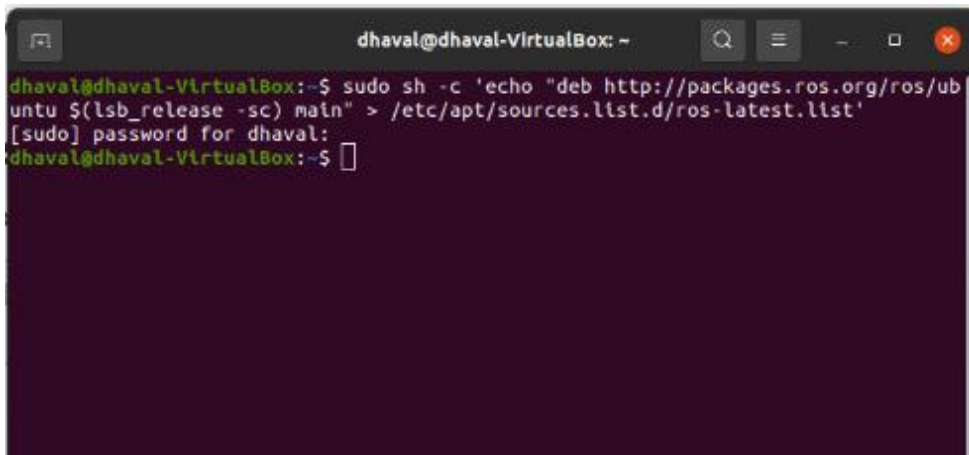
201901145 – GARGEY PATEL

ROS installation process

- Run following commands in terminal to install ROS in ubuntu

➔ Setup your computer to accept software from packages.ros.org.

```
sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
```

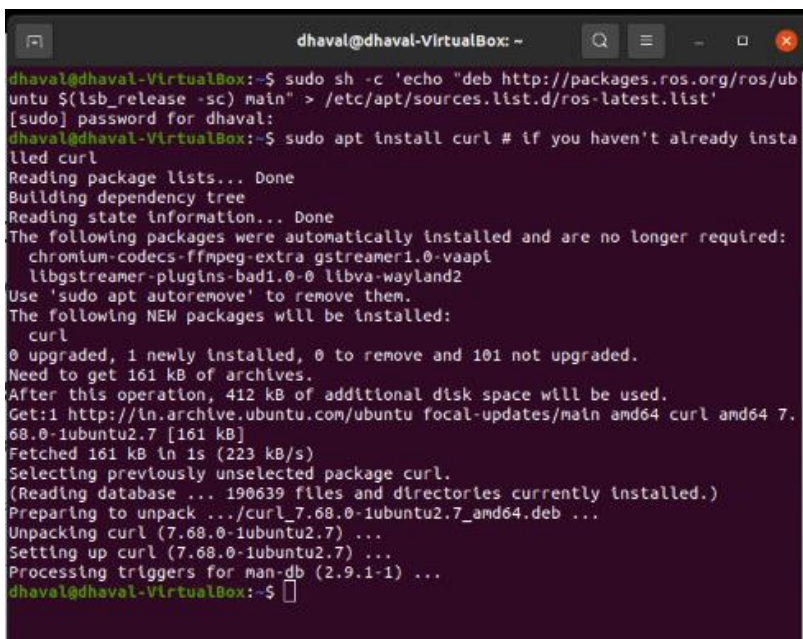


```
dhaval@dhaval-VirtualBox: ~  
dhaval@dhaval-VirtualBox:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'  
[sudo] password for dhaval:  
dhaval@dhaval-VirtualBox:~$
```

➔ Setup your keys

```
sudo apt install curl # if you haven't already installed curl
```

```
curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc |  
sudo apt-key add -
```



```
dhaval@dhaval-VirtualBox:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'  
[sudo] password for dhaval:  
dhaval@dhaval-VirtualBox:~$ sudo apt install curl # if you haven't already installed curl  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi  
  libgstreamer-plugins-bad1.0-0 libva-wayland2  
Use 'sudo apt autoremove' to remove them.  
The following NEW packages will be installed:  
  curl  
0 upgraded, 1 newly installed, 0 to remove and 101 not upgraded.  
Need to get 161 kB of archives.  
After this operation, 412 kB of additional disk space will be used.  
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 curl amd64 7.68.0-1ubuntu2.7 [161 kB]  
Fetched 161 kB in 1s (223 kB/s)  
Selecting previously unselected package curl.  
(Reading database ... 190639 files and directories currently installed.)  
Preparing to unpack .../curl_7.68.0-1ubuntu2.7_amd64.deb ...  
Unpacking curl (7.68.0-1ubuntu2.7) ...  
Setting up curl (7.68.0-1ubuntu2.7) ...  
Processing triggers for man-db (2.9.1-1) ...  
dhaval@dhaval-VirtualBox:~$
```

→ Installation

```
sudo apt update
```

```
dhaval@dhaval-VirtualBox: ~  
chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi  
libgstreamer-plugins-bad1.0-0 libva-wayland2  
Use 'sudo apt autoremove' to remove them.  
The following NEW packages will be installed:  
  curl  
0 upgraded, 1 newly installed, 0 to remove and 101 not upgraded.  
Need to get 161 kB of archives.  
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Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 curl amd64 7.68.0-1ubuntu2.7 [161 kB]  
Fetched 161 kB in 1s (223 kB/s)  
Selecting previously unselected package curl.  
(Reading database ... 190639 files and directories currently installed.)  
Preparing to unpack ../curl_7.68.0-1ubuntu2.7_amd64.deb ...  
Unpacking curl (7.68.0-1ubuntu2.7) ...  
Setting up curl (7.68.0-1ubuntu2.7) ...  
Processing triggers for man-db (2.9.1-1) ...  
dhaval@dhaval-VirtualBox:~$ sudo apt update  
Get:1 http://packages.ros.org/ros/ubuntu focal InRelease [4,676 B]  
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease  
Err:1 http://packages.ros.org/ros/ubuntu focal InRelease  
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY F42ED6FBAB17C654  
Hit:3 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease  
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease  
Hit:5 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease  
Reading package lists... Done  
W: GPG error: http://packages.ros.org/ros/ubuntu focal InRelease: The following signatures couldn't be verified because the public key is not available: NO_PUBKEY F42ED6FBAB17C654  
E: The repository 'http://packages.ros.org/ros/ubuntu focal InRelease' is not signed.  
N: Updating from such a repository can't be done securely, and is therefore disabled by default.  
N: See apt-secure(8) manpage for repository creation and user configuration details.  
dhaval@dhaval-VirtualBox:~$
```

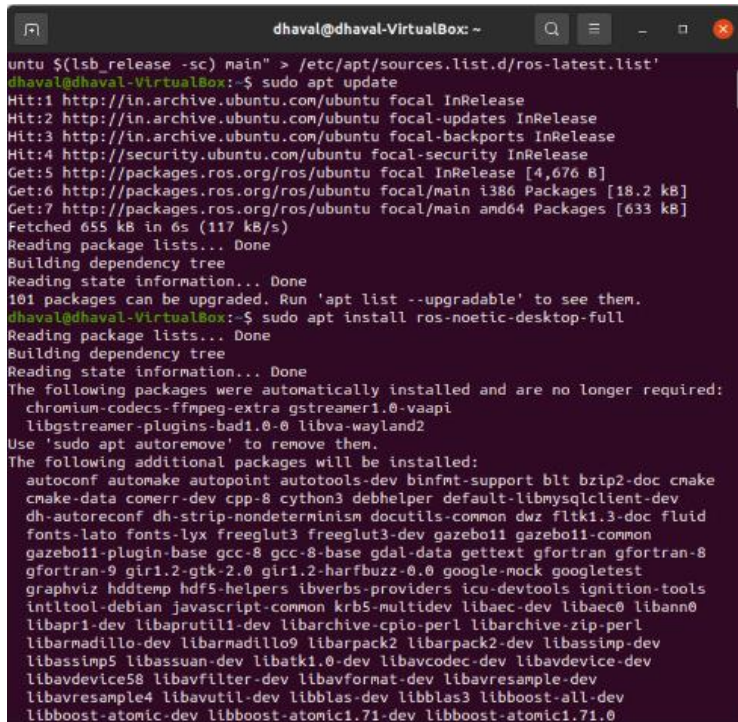
Desktop full install

```
sudo apt install ros-noetic-desktop-full
```

```
dhaval@dhaval-VirtualBox: ~  
Hit:2 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease  
Hit:3 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease  
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease  
Ign:5 http://mirror.clarkson.edu/ros/packages.ros.org/mirror/packages.ros.org/ros/ubuntu focal InRelease  
Err:6 http://mirror.clarkson.edu/ros/packages.ros.org/mirror/packages.ros.org/ros/ubuntu focal Release  
  404 Not Found [IP: 128.153.145.19 80]  
Reading package lists... Done  
E: The repository 'http://mirror.clarkson.edu/ros/packages.ros.org/mirror/packages.ros.org/ros/ubuntu focal Release' does not have a Release file.  
N: Updating from such a repository can't be done securely, and is therefore disabled by default.  
N: See apt-secure(8) manpage for repository creation and user configuration details.  
dhaval@dhaval-VirtualBox:~$ sudo apt install ros-noetic-desktop-full  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
E: Unable to locate package ros-noetic-desktop-full  
dhaval@dhaval-VirtualBox:~$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'  
dhaval@dhaval-VirtualBox:~$ sudo apt update  
Hit:1 http://in.archive.ubuntu.com/ubuntu focal InRelease  
Hit:2 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease  
Hit:3 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease  
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease  
Get:5 http://packages.ros.org/ros/ubuntu focal InRelease [4,676 B]  
Get:6 http://packages.ros.org/ros/ubuntu focal/main i386 Packages [18.2 kB]  
Get:7 http://packages.ros.org/ros/ubuntu focal/main amd64 Packages [633 kB]  
Fetched 655 kB in 6s (117 kB/s)  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
101 packages can be upgraded. Run 'apt list --upgradable' to see them.  
dhaval@dhaval-VirtualBox:~$
```

→ Environment setup

```
echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
```



A terminal window titled 'dhaval@dhaval-VirtualBox: ~' showing the process of setting up ROS Noetic on Ubuntu Focal. The user runs `$(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'` and then `sudo apt update`. The terminal output shows the update process, including fetching package lists and building the dependency tree. It then lists packages that can be upgraded and proceeds to install `ros-noetic-desktop-full`. The terminal also shows the removal of packages that are no longer required and lists additional packages that will be installed as dependencies.

```
untu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
dhaval@dhaval-VirtualBox:~$ sudo apt update
Hit:1 http://in.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu focal-security InRelease
Get:5 http://packages.ros.org/ros/ubuntu focal InRelease [4,676 B]
Get:6 http://packages.ros.org/ros/ubuntu focal/main i386 Packages [18.2 kB]
Get:7 http://packages.ros.org/ros/ubuntu focal/main amd64 Packages [633 kB]
Fetched 655 kB in 6s (117 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
101 packages can be upgraded. Run 'apt list --upgradable' to see them.
dhaval@dhaval-VirtualBox:~$ sudo apt install ros-noetic-desktop-full
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi
  libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  autoconf automake autopoint autotools-dev binfmt-support blt bzip2-doc cmake
  cmake-data comerr-dev cpp-8 cython3 debhelper default-libmysqlclient-dev
  dh-autoreconf dh-strip-nondeterminism docutils-common dwz fltk1.3-doc fluid
  fonts-lato fonts-lyx freeglut3 freeglut3-dev gazebo11 gazebo11-common
  gazebo11-plugin-base gcc-8 gcc-8-base gdal-data gettext gfortran gfortran-8
  gfortran-9 gir1.2-gtk-2.0 gir1.2-harfbuzz-0.0 google-mock googletest
  graphviz hddtemp hdf5-helpers ibverbs-providers icu-devtools ignition-tools
  intltool-debian javascript-common krb5-multidev libaec-dev libaec0 libann0
  libapr1-dev libaprutil1-dev libarchive-cpio-perl libarchive-zip-perl
  libarmadillo-dev libarmadillo9 libarpack2 libarpack2-dev libassimp-dev
  libassimp5 libassuan-dev libatk1.0-dev libavcodec-dev libavdevice-dev
  libavdevice58 libavfilter-dev libavformat-dev libavresample-dev
  libavresample4 libavutil-dev libblas-dev libblas3 libboost-all-dev
  libboost-atomic-dev libboost-atomic1.71-dev libboost-atomic1.71.0
```

Python codes

e1.py :

```
#Printing sentences
print("Hello world")
print("Welcome to IE 410 - Introduction to Robotics")
```

e2.py :

```
#Arithmetic operations
a = 5
b = 2
print("a is", a, "and", "b is", b) #printing a and b
print("a+b is", a+b) #printing value of a+b
print("a-b is", a-b) #printing value of a-b
print("a*b is", a*b) #printing value of a*b
print("a/b is", a/b) #printing value of a/b
print("a%b is", a%b) #printing value of a%b
print("a^b is", a**b) #printing value of a^b
```

e3.py :

```
#printing array and sum of its element
array = [10,20,30,40,50]
print("Array elements are",array) #printing array
elements
sum = 0
for i in array:
    sum = sum + i
print("Sum of its elements is",sum)
```

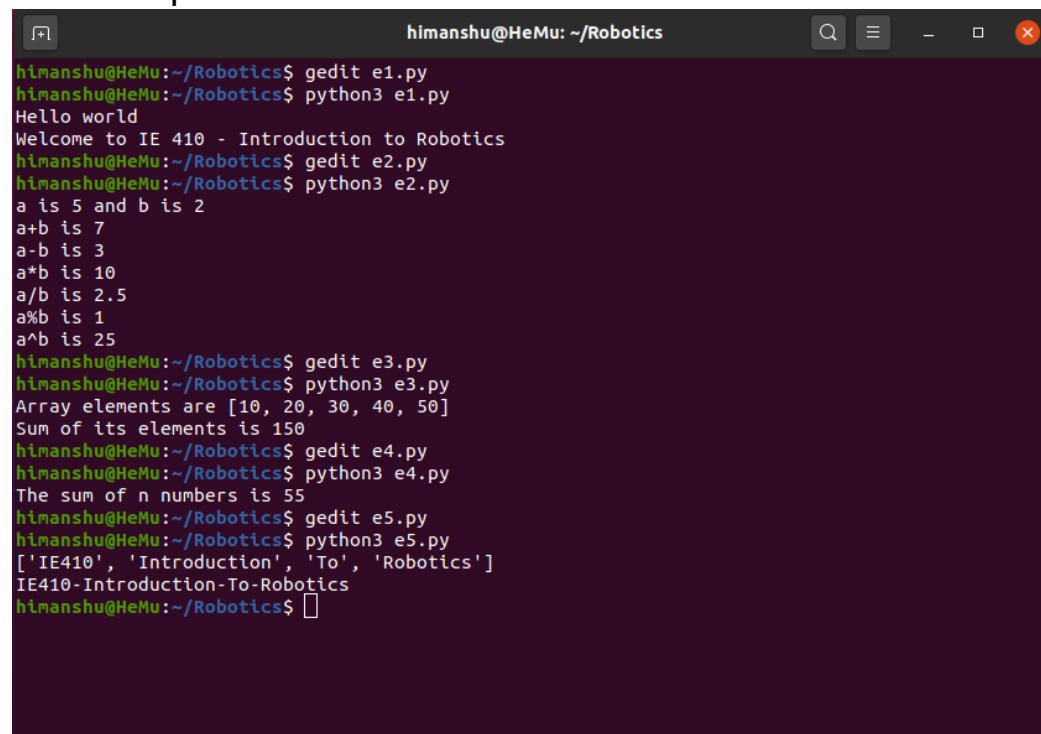
e4.py :

```
#Sum of n natural numbers
n = 10
if n < 0:
    print("Enter a positive number")
else:
    sum = 0
    while(n > 0):
        sum += n
        n -= 1
    print("The sum of n numbers is", sum)
```

e5.py :

```
#String
string = " IE410 Introduction To Robotics "
split_string = string.split() #splits string
print(split_string)
joined_string = '-'.join(split_string) #join string
print(joined_string)
```

Code output:

A terminal window titled 'himanshu@HeMu: ~/Robotics' with standard window controls. It shows a series of commands and their outputs: creating and running e1.py (Hello world), e2.py (arithmetic operations), e3.py (array operations), e4.py (sum of numbers), and e5.py (string splitting and joining).

```
himanshu@HeMu:~/Robotics$ gedit e1.py
himanshu@HeMu:~/Robotics$ python3 e1.py
Hello world
Welcome to IE 410 - Introduction to Robotics
himanshu@HeMu:~/Robotics$ gedit e2.py
himanshu@HeMu:~/Robotics$ python3 e2.py
a is 5 and b is 2
a+b is 7
a-b is 3
a*b is 10
a/b is 2.5
a%b is 1
a^b is 25
himanshu@HeMu:~/Robotics$ gedit e3.py
himanshu@HeMu:~/Robotics$ python3 e3.py
Array elements are [10, 20, 30, 40, 50]
Sum of its elements is 150
himanshu@HeMu:~/Robotics$ gedit e4.py
himanshu@HeMu:~/Robotics$ python3 e4.py
The sum of n numbers is 55
himanshu@HeMu:~/Robotics$ gedit e5.py
himanshu@HeMu:~/Robotics$ python3 e5.py
['IE410', 'Introduction', 'To', 'Robotics']
IE410-Introduction-To-Robotics
himanshu@HeMu:~/Robotics$
```